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## Socio-Demographic Factors Determining Expectation Experienced while Using Modern Technologies in Personal Financial Management (PFM and robo-advice): A Polish Case

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**Abstract:**

**Purpose:** The article aims to uncover the dependencies in the use of modern technologies to plan personal finances in two key areas: career advice and computer software that monitors spending habits and suggests improvements.

**Design/Methodology/Approach:** Conclusions are drawn based on statistical methods. The Chi-square test was used to test the independence of the relationship of two variables expressed on a qualitative scale. Kendall's  $\tau$  correlation coefficient was used to investigate the relationship of two variables expressed on an ordinal scale.

**Findings:** Analysis of data obtained from customer surveys assessing their expectation with the use of modern technologies indicates that the vast majority of respondents would not be happy if a computer program made investment decisions on their behalf. At the same time, the respondents mostly expressed a willingness for a computer program to analyse their spending habits and recommend improvements.

**Practical Implications:** Study showed that level of education did not affect the assessment of robo-advice concerning investment decisions, but it did influence willingness to receive investment proposals. People with higher education would be more likely to use a computer program that would analyse their expenses and suggest improvements.

**Originality/value:** This article deals with the subject of innovation in finance, focusing on robo-advisory services and PFM applications. Since automatic financial advisory services in Poland still enjoy little popularity, we decided to conduct our own research on users of robo-advice in Poland – the first study of its kind.

**Keywords:** Personal finance; modern technologies; robo-advice, personal finance planning.

**JEL classification:** C13, C22, C53, F31, G11.

**Paper Type:** Research study.

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## **1. Introduction**

Advice is essential for people to achieve their financial goals and dreams. Technology has made it so much easier for consumers to access information, and advisors need to recognize how this impacts their role (Crager and Hummel, 2016). The development of new technologies, innovations, and digitization is becoming a challenge that the financial sector must face. The shift in expectations and needs of customers and investors and the changing environment and market (the impact of, among others, SARS-CoV-2) are influencing a new approach adopted by financial institutions towards investor relations. The use of technological factors in financial services occurs mainly in payments, investments, loans, and insurance. Modern information technologies and the implementation of new solutions and financial tools also support planning personal finances via an automatic advisor that makes decisions on behalf of the client (Waliszewski, 2020).

One might ask oneself about the extent to which the human factor might optimally be substituted by artificial intelligence and computer programs used to manage the investment portfolio. The starting point for the authors' considerations is the identification of robo-advice within fin-tech and analysis of investor profiles in other countries. Based on our conducted research, the article offers an evaluation of automatic financial advice in Poland by its users and analyses the factors determining the use of robo-advisory services in asset management. In the study, the authors aim to present the current profile of robo-advice users in Poland.

## **2. Literature Review**

Digital technologies (Tanda and Schena, 2019, pp. 101-107) and their impact on consumer decisions currently stand at the forefront of international discourse on consumer politics (Skinner, 2018; Jagtiani and Kose, 2018, pp. 1-6). The impact of modern financial technologies on data transfer and security, consumer privacy, the responsibility of financial service providers on online platforms and digital consumer education (Świecka *et al.*, 2020, pp. 1-17) are just some of the issues that currently provoke intense discussion (Thorun and Diels 2020, pp. 177-191). New factors that determine consumer behaviour on financial markets are inherently associated with the creation of a new environment for consumers, which consists of a sense of security, consumer confidence and elements affecting consumer satisfaction (Jacobson and Mizik, 2009, pp. 810-819; Shkarlet, Dubyna, and Zhuk, 2018, pp. 349-357).

Consumer financial behaviour is observable both on the traditional as well as alternative market (see European Commission, 2008, pp. 61-84). The decisions made by consumers on the main market are centred around transactions conducted via traditional financial institutions, such as banks or insurance companies. On the alternative market, consumer financial behaviour involves measures taken to meet

financial needs that bypass financial institutions. The development of the fintech sector (Gomber *et al.*, 2018, pp. 220-265) allows third parties to mediate their clients' financial management and secure the transfer of financial data from banks to the services that support the independent management of home budgets via personal financial management applications (Gafrikova, Szczesny and Odrzygóźdź, 2015, pp. 39-52). The use of artificial intelligence in financial consulting provides the basis for digital financial consulting platforms. For individual investors, decision-making depends on previously defined needs (Brunel, 2003, pp. 10-20; Nevins, 2004, pp. 8-23; Das *et al.*, 2010, pp. 311-334). Their investment goals are focused, *inter alia*, on ensuring the ongoing functioning of their household as well as security for their own future and retirement, as well as the future and education of their children (Chang Kim *et al.*, 2019, pp. 515-526).

Personal finance management, and planning especially (Waliszewski, 2014, pp. 111-134), is extremely relevant due to the threats to which households are exposed. It covers various areas such as: asset acquisition planning, liability and insurance planning, savings and investment planning, employee benefits planning, tax planning, retirement and estate planning (Billingsley, Gitman, and Joehnk, 2016, pp. 16-18). Consumer lifestyle, threat of insolvency, quick access to debt financing, turbulence in the economy and lack of long-term plans are just a few reasons that may lead to the erosion of personal finances. Budget monitoring by household members can prevent insolvency, offer security and ensure an adequate level of satisfaction and financial contentment (Harrison, 2005, pp. 3-16; Mampuni and Sukarno, 2014, pp. 444-459). Robo-advice is defined as an automated investment platform that uses quantitative algorithms to manage investors' portfolios and is accessible to clients online (Beketov, Lehmann, and Wittke, 2018, pp. 363-364). Robo-advisors differ from existing online investment platforms or online brokerage with respect to two different conceptual levels: customer assessment, and customer portfolio management (Jung, Dorner, Glaser, and Morana, 2018, pp. 81-86; Jung, Glaser, and Köpplin, 2019, pp. 405-427).

Research on robo-advice focuses on US users due to the fact that it is the largest and oldest market. One indication that emerged is that users of robo-advisory services are young and confident in their financial abilities yet distrustful of traditional channels of financial advice (Woodyard and Grabe, 2018, pp. 55-66). Other findings suggest that willingness to use robo-advisors may increase according to positive emotions expected from use, while it may also decrease along with anticipated negative emotions, and that the relationship may be altered by inducing individuals' self-enhancement motives (eg, the possibility of accumulating wealth) (Hohenberger, Lee, and Coughlin, 2019, pp. 1-14). On the basis of the empirical data available, it should be pointed out that the number of studies on customer satisfaction with online financial services is limited (Johnson *et al.*, 2008, pp. 416-443). The analyses carried out so far (Szymanski and Henard, 2001; Lundahl *et al.*,

2009, pp. 581-594; Sabri, 2011, pp. 54-84) do not refer directly to the assessment of which socio-demographic traits may have a statistical impact on the level of consumer satisfaction with the use of modern personal finance technologies that involve robo-advice and the monitoring of spending habits. The use of technological factors in financial services occurs mainly in payments, investments, loans, and insurance. Modern information technologies and the implementation of new solutions and financial tools also support planning personal finances via an automatic advisor that makes decisions on behalf of the client (Waliszewski 2020, pp. 12-20; Warchlewska and Waliszewski, 2020, pp. 51-68). This topic is relevant due to the fact that the use of remote channels in financial transactions is impelled by pace of life, lifestyle, culture, profession, health and unforeseen random circumstances.

### 3. Methodology

The statistical material used in the article stems from the *ING International Survey – New Technologies 2019*. This online survey was carried out by Ipsos from 30 January to 11 February 2019. Sampling reflects gender ratios and age distribution, selecting from pools of possible respondents furnished by panel providers in each country. European consumer figures are expressed as an average, weighted to take the varying populations of the countries into account. 14,824 respondents from 15 countries (Austria, Belgium, Czech Republic, Germany, Italy, Luxembourg, Netherlands, Poland, Romania, Spain, Turkey, United Kingdom, USA, Australia) were involved in the survey. The article uses data for Poland made available directly by ING Bank Śląski economists for scientific purposes. 1,016 respondents were surveyed in Poland, whose descriptive statistics are presented in Table 1.

**Table 1.** *Descriptive statistics of the studied population (N = 1016)*

Category	Variants of the categories	N	%	Category	Variants of the categories	N	%
Age	18-35	268	26,40%	Education	Primary	27	2,70%
	36-45	245	24,10%		Secondary	500	49,20%
	46-65	416	40,90%		Vocational	58	5,70%
	Over 66	87	8,60%		BA	123	12,10%
Sex	Female	537	52,90%	Income [euro]	MA	308	30,30%
	Male	479	47,10%		0-249	39	4,20%
Economic activity	Student	41	4,00%		250-499	83	8,90%
	Unemployed	93	9,20%		500-999	285	30,60%
	Employed	626	61,60%		1000-1499	263	28,20%
	Self-employed	74	7,30%		1500-1999	131	14,10%
	Retired	182	17,90%		2000-2499	78	8,40%
Household	1 person	94	9,30%		2500-2999	21	2,30%
	2 people	256	25,20%		3000-3499	11	1,20%
	3 people	263	25,90%		3500-3999	5	0,50%

	4 people	258	25,40%		4000-4999	2	0,20%
	5 people	103	10,10%		6000-6999	5	0,50%
	6 or more	42	4,10%		Over 7000	8	0,90%

**Source:** ING International Survey – New Technologies (2019).

Regarding the use of modern technologies in personal financial management, the respondents were presented with two statements to evaluate their level of expectation:

1. I would be happy for a computer program to make investment decisions on my behalf.
2. I would be happy for a computer program to analyse my spending habits and recommend improvements.

The respondents responded to these statements on a 5-point Likert scale: 1 – totally disagree, 2 – disagree, 3 – difficult to say, 4 – agree, 5 – totally agree.

In order to analyse the data, the following statistical methods were employed:

- 1) The Chi-square test for independence: a nonparametric method for testing the relationship between two variables expressed on a qualitative scale. These were socio-demographic variables with 2 questions on a 5-point scale.
- 2) Kendall's  $\tau$  correlation coefficient: a nonparametric test used to examine the relationship between two variables expressed on the ordinal scale. Applied to the relationship between the survey and socio-demographic questions that were graded (rated on a scale from the lowest to the highest).

The following research hypotheses were formulated:

- H1: Socio-demographic factors differentiate how willing the respondents are to have a computer program analyse their spending habits and recommend improvements to a greater extent than their willingness to have investment decisions made on their behalf.*
- H2: Opinions regarding financial robo-advice are most strongly influenced by age and employment.*
- H3: There is no relationship between gender and the level of expectation with a computer program making investment decisions, analysing spending habits, and suggesting improvements.*
- H4: Education does not influence evaluation of financial robo-advice for making investment decisions, but it does impact willingness to have the budget analysed and improvements recommended. People with higher education would be more likely to use a computer program that would analyse their expenses and suggest improvements.*

#### 4. Empirical Results

The presented research problem is a novel one, and the results of the study have practical significance and application value for entities offering households automatic financial advice and budget monitoring (PFM applications).

The study is based on reliable source data. Of the group of Poles surveyed, the vast majority would not be happy with a computer program making investment decisions on their behalf.

Most respondents expressed some willingness for a computer program to analyse their spending habits and recommend improvements. Kendall's  $\tau$  correlation coefficient showed that the relationship between both responses was statistically significant in the analysed group  $\tau = .34$ ;  $p < .001$ . This relationship was positive, which means that people who were more willing to let a computer program make investment decisions for them were also more willing to have their spending habits analysed. This relationship was moderately strong.

It was then investigated whether the socio-demographic traits of the respondents were related to their opinions on financial robo-advice. For this purpose, a series of analyses were performed using the Chi-square test for independence and Kendall's  $\tau$  correlation. Table 2 presents the results of these analyses in terms of the distribution of responses on financial robo-advice in the area of making investment decisions.

**Table 2.** Results of analyses using the Chi-square test for independence and Kendall's  $\tau$  correlation regarding the relationship between socio-demographic variables and opinions on financial robo-advice in the area of making investment decisions

	Chi-square				Kendall's $\tau$ correlation	
	$\chi^2$	df	p	V	$\tau$	p
Age	32.21	12	0.001		-0.03	0.281
Sex	5.67	4	0.225	0.08		
Employment	27.05	16	0.041	0.08		
Number of people in the household	23.26	20	0.276		0.05	0.038
Education	13.32	16	0.649		-0.01	0.589
Income	5.79	8	0.671		-0.02	0.413

**Note:**  $\chi^2$ - Chi-square statistics, df- degrees of freedom, p- level of statistical significance, V- Cramer's V strength of dependence,  $\tau$  – Kendall's  $\tau$  correlation.

**Source:** Own study.

The analysis of Kendall's  $\tau$  correlation demonstrated that the age of the respondents was not statistically significantly related to the opinion on investment decisions made by a computer program  $\tau = .03$ ;  $p = .281$ .

The next analysis did not indicate that the opinion on financial robo-advice for making investment decisions was related to the sex of the respondents  $\chi^2(4) = 5.67$ ;  $p = .225$ ;  $V = 0.08$ . The percentage of men and women who are, or are not, happy with a computer program making investment decisions was similar.

However, a statistically significant relationship was demonstrated between professional circumstances and opinion on financial robo-advice for making investment decisions  $\chi^2(16) = 27.05$ ;  $p < .05$ ;  $V = .08$ . Self-employed and working people had the greatest confidence in computer programs making investment decisions, and the least trust was manifested by people in education or retired.

Next, the relationship between opinions on investment decisions made by robo-advice and the number of people in the household was examined. The analysis of Kendall's  $\tau$  correlation indicated that this relationship was statistically significant  $\tau = .05$ ;  $p < .05$  and positive. The more people in the household, the greater the willingness to entrust investment decisions to robo-advice.

Additionally, using Kendall's  $\tau$  correlation analysis, the relationship between opinions on investment decisions made by robo-advice and the level of education was examined. The result of the correlation analysis turned out to be statistically insignificant  $\tau = -.01$ ;  $p = .587$ . Therefore, it cannot be concluded that the level of education is related to the willingness to use robo-advice in order to make investment decisions

An analysis performed via Kendall's  $\tau$  correlation examined the relationship between opinions on investment decisions made by robo-advice and the level of income. In this case too, the result of the correlation analysis turned out to be statistically insignificant  $\tau = -.02$ ;  $p = .413$ . Therefore, it cannot be concluded that the income level is related to the willingness to use robo-advice in order to make investment decisions.

A similar series of analyses using the Chi-square test for independence was made to examine the relationship between socio-demographic factors and opinion on financial robo-advice in terms of analysing spending habits. The results are presented in Table 3.

**Table 3.** Results of analyses using the Chi-square test for independence on the relationship between socio-demographic variables and opinion on financial robo-advice with regard to analysing spending habits

	Chi-square				Kendall's $\tau$ correlation	
	$\chi^2$	$df$	$p$	$V$	$\tau$	$p$
Age	74.50	12	0.000		-0.20	0.000
Sex	6.28	4	0.179	0.08		
Employment	43.30	16	0.000	0.10		

Number of people in the household	31.33	20	0.051		0.09	0.001
Education	34.10	16	0.005		-0.02	0.543
Income	9.74	8	0.284		-0.03	0.259

**Note:**  $\chi^2$  – Chi-square statistics,  $df$  – degrees of freedom,  $p$  – level of statistical significance,  $V$  – Cramer's  $V$  strength of dependence,  $\tau$  – Kendall's  $\tau$  correlation.

**Source:** Own study.

Using Kendall's  $\tau$  correlation analysis, it was revealed that in the study group age was statistically significantly associated with opinions about a computer analysing spending habits and suggesting improvements  $\tau = -.20$ ;  $p < .001$ . This relationship was negative, so it can be concluded that the elderly were less likely to want a computer to analyse their financial behaviour.

The next analysis did not indicate that opinion on financial robo-advice in terms of analysing spending habits is related to the sex of the respondents  $\chi^2(4) = 6,28$ ;  $p = 0,179$ ;  $V = 0,08$ . The percentage of women and men happy with a computer program analysing spending habits was similar and amounted to 46.3% for women and 43.1% for men, respectively.

However, a statistically significant relationship was demonstrated between professional circumstances and opinion on financial robo-advice for investment decisions  $\chi^2(16) = 43,30$ ;  $p < 0,001$ ;  $V = 0,10$ . Students and working adults had the greatest confidence in computer programs analysing spending habits.

Then, by using Kendall's  $\tau$  correlation, it was proved that opinions regarding computer analysis of financial behaviour and suggestions of improvement was statistically significantly associated with the number of people in the household  $\tau = .09$ ;  $p < .01$ . This relationship was positive, so it can be concluded that the more people in the household, the more people would be more willing to use robo-advice to analyse their financial behaviour and propose improvements.

Kendall's  $\tau$  correlation analysis indicated that opinions on the use of robo-advice to analyse financial behaviour was not statistically significantly related to education  $\tau = -.02$ ;  $p = .543$ . Therefore, it cannot be concluded that the two variables are connected.

Additionally, a further analysis of Kendall's  $\tau$  correlation did not uncover a statistically significant relationship between the income of the respondents and their opinion on robo-advice analysing their financial behaviour  $\tau = -.03$ ;  $p = .259$ .

## 5. Conclusions and Limitations

The authors of the article are not aware of any similar research in both domestic and foreign literature. The research conducted on the robo-advisory market touched upon



issues such as: (a) characteristics of U.S. consumers in their current and expected use of robo-advisory services, traditional financial planning services, or a combination of the two services (Fulk, Grable, Watkin, and Kruger, 2018), (b) whether robo-advisors, reduce investors' demand for human financial advice offered by financial service providers (Brennera and Meyll, 2019), (c) U.S. Investors' Perceptions of Human vs. Robo-Advice (Saad, 2019), (d) whether robo-advisors do in fact provide personal investment advice, minimise costs, and are free from conflicts of interest, meet a high fiduciary standard of care and act in the client's best interest (Fein, 2015; Megan, 2017), (e) analysis of 219 existing robo-advisors worldwide and showing that Modern Portfolio Theory remains the main framework used in RAs (Jung, Dorner, Glaser, and Morana, 2018), (f) analysis of American investors considering the characteristics of those who exclusively use robo-advisory services and how they differ from those who exclusively use brokers and financial advisors (Woodyard and Grable, 2018), (g) use of robo-advice by the Millennials Generation (Culter, 2015).

In terms of monitoring the household budget, including keeping track on expenses by using modern technologies, research was carried out, *inter alia*, in the scope of: (a) planning as an element of household budget management (Waliszewski, 2014; Billingsley, Gitman, and Joehnk, 2016), (b) diagnosis of the purpose for using online tools (Chang, Kim, *et al.*, 2019; Litterscheidt and Streich, 2020), (c) supervision of personal finances (Harrison, 2005; Mampuni and Sukarno, 2014) (d) consumer skills in terms of using financial technologies (Świecka *et al.*, 2020), (e) consumer confidence, (f) security (Jacobson and Mizik, 2009; Shkarlet, Dubyna, and Zhuk, 2018) as well as (f) the functionalities of transaction services (Gafrikova, Szczesny, and Odrzygóźdź, 2015).

This study supplements the research approach by determining the statistical significance and strength of the relationship between individual socio-demographic traits of the respondents, such as age, gender, employment, number of people in the household, level of education, income and expectation with the use of modern technologies in personal financial robo-advice, and a computer program monitoring spending habits and suggesting improvements.

Comparative analysis of the survey results yielded by respondents in Poland and other countries investigated may provide some interesting conclusions, although such an analysis exceeds the scope of this article.

Based on the empirical material gathered for the International Survey – New Technologies 2019, it may be concluded that respondents who were willing to entrust financial decisions to a computer program were also willing to diagnose their habits via a computer program. Most respondents expressed a willingness for a computer program to analyse their spending habits and recommend improvements,

so there are no grounds to reject H1. The percentage of people interested in remote assistance in making investment decisions and, similarly, in analysing spending habits is inversely proportional to age. Professionally active people had the greatest confidence in modern technologies making investment decisions compared to pensioners and students. In the case of analysing spending habits, students and professionally active people had the greatest confidence.

Therefore, hypothesis H2 that age and employment have the strongest influence on opinion regarding financial robo-advice should be confirmed. No significance regarding gender was diagnosed, so H3 may be confirmed in that there is no relationship between gender and expectation with a computer program making investment decisions, analysing spending habits and suggesting improvements. Opinion on financial robo-advice for making investment decisions was not shown to be related to education. The percentage of those dissatisfied with making investment decisions is inversely proportional to educational level. It was demonstrated that opinion regarding financial robo-advice for spending analysis is related to education.

This leads to a positive verification of H4. In addition, respondents with an income above 1000 Euro are more enthusiastic about modern solutions. Expectation with the use of computer programs in the decision-making process and financial analysis was found to be significantly related to income. The number of people in the household is directly proportional to the propensity to analyse spending via a computer program. However, this factor did not influence investment decisions. People with higher education would be more likely to use a computer program to analyse their expenses and suggest improvements.

The research issues presented here are novel, and the results have practical significance and application value for entities offering automatic financial advice and household budget monitoring.

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